of the organs of sense which are constantly deceiving him. His conduct is therefore a complete *reductio ad absurdum* of his theory.

In the second chapter we have a presentation of the views of A. W. Volkmann, Wilhelm Wundt, and other physiologists and physiological psychologists in opposition to Müller's law of specific sense-energies, which is shown to be inconsistent with the facts of biology and the modern theory of descent. Interesting in this connexion are the experiments of Graber, Plateau, and others with worms and reptiles, proving that they distinguish light from darkness by means of the surface of the skin, and Sir John Lubbock's observations of ants and wood-lice, all of which are incompatible with Rosenthal's formulation of Müller's law. The third chapter defines Lotze's attitude to this law and is followed by sections on vitalism and spiritualism, Kant and Lotze, the correct interpretation of Müller's law by G. H. Meyer in conformity with the doctrine of descent, the logical method of natural philosophy, the scientific and speculative significance of conceptions, acoustics with a criticism of Helmholtz's theory of tone-sensations and its influence on other theries, and finally a lucid exposition of the author's philosophy of sensation, in which he maintains that thinking is a secondary function and that the primary source of all knowledge lies in the sensations, of which the understanding is a product. Mind is therefore naturally and gradually developed out of the feelings, and it is the purpose of this concluding chapter to trace this process of evolution in connexion with the growth and co-ordination of the organs of touch, taste, smell, hearing, and seeing in the child from the moment of its birth as observed and described by Meynert, Preyer, and Genzmer. "Thought," says Feuerbach," is nothing but a past sensation, a sensation that no longer exists, an indirect, nullified, negatived sensation. A thing does not become an object of thought until it has vanished from view and from sensation. The question What is lightning? does not arise until the lightning is past." In general, thinking is feeling extended to remote or absent objects; it is feeling what is no longer really felt, or seeing what is no longer actually seen. We see the external movement of the mass with the bodily eye; we see with the mind's eye or think the inner movement of the molecules of which the mass is composed; but it is through the visible massive movement that the invisible molecular movement is revealed to us.

It is impossible in this brief notice to enter into a critical discussion of the questions here involved. Whether our readers may accept or repudiate Rau's conclusions, they can hardly fail to be interested in his thoroughly independent and masterly exposition of the relations between feeling and thinking in the light of recent physiological and biological researches and under the all-pervading influence of the doctrine of evolution. E. P. E.

CONTRIBUTIONS TO THE ANALYSIS OF THE SENSATIONS. By *Dr. Ernst Mach*, formerly Professor of Physics in the University of Prague, now Professor of the History and Theory of Inductive Science in the University of Vienna.

Translated by *C. M. Williams*. With Thirty-seven Cuts. Chicago: The Open Court Publishing Co. 1897. Pages, 208. Price, $1.25 net.

The present work has in this translation experienced considerable augmentation at the hands of the author. Numerous notes have been added completing the discussions and bringing them down to date, while two appendices containing much supplementary and explanatory matter have been incorporated in the book. The first appendix on "Facts and Mental Symbols" is of extreme importance to students of the history and theory of science, as an effort to do away altogether with the dualism of feeling and motion, of an inward subjective world and an outward objective reality. It is a species of autobiographical apologia for the splendid "Introductory Remarks" to the book, which aim at banishing the metaphysical from scientific reasoning, and it hence throws much light on the growth of scientific hypotheses. In both these chapters Professor Mach seeks a monistic theory of the world which is faultlessly and genuinely monistic. That view of monism which sees in mind and matter two *aspects* of existence he regards as disguised dualism. To him the contrast between the psychical and the physical is not a duality but an identity. It is simply a connexion in a different way of the same fundamental elements of the world. An independent, underlying metaphysical nucleus of reality, which by its actions produces sensations, Professor Mach does not admit. All such hypotheses he regards as figments of the unconsciously acting, natural intellect in its effort at explaining things which need no explanation. To him the elements of the world are given in sensations. The different connexions of these elements alone determine the psychical or the physical character of the relations of the world. The world is, so to speak, a viscous *continuum* of elements, showing more coherency and density at certain spots, in which spots the elements are, metaphorically speaking, centred and focussed. These spots are the egos. There is no gulf between the ego and the world. "A variously interconnected content of consciousness is in no respect more difficult to understand than a rich and diversified interconnexion of the world." For the real world and the perceived world are one,—different settings only of the kaleidoscopic[1] play of the elements. This view has been characterised as idealism, as sensationalism, and as phenomenalism, and in an historical sense the designation is correct. But it is a dangerous and prejudicial practice to apply to *any* new and carefully worked-out theory a name having fixed and condemnatory historical connotations. No such characterisations, therefore, are to the point. Professor Mach insists that his view is *realism* in the true sense of that word, and that, despite the appearance of such to the inattentive reader, it is *not* Berkeleianism. Both the Introductory Remarks and the first Appendix are a specimen of *descriptive* philosophical analysis which both philosophical and scientific students will do well to study.

As to the matter proper of the book it has arisen from the conviction of the

[1] Not the author's word, of course

author that "the foundations of science as a whole and of physics in particular, await their next greatest elucidations from the side of biology, and especially from the analysis of the sensations." The chapters of the book are a connected recapitulation of all that the author has done in psychology which, despite its small volume, is in both contents and method of rare value. As the translator well says: "The matter contained in a book is by no means proportioned to its size. If this were so, the present treatise . . . must be a bulky one."

The principle which is at the basis of the research of the present work is that there are as many physico-chemical neural processes as there are distinguishable qualities of sensation. This is the principle of the complete parallelism of the psychical and physical. Such was Helmholtz's explanation of tone-sensation, etc. To the exposition of this fruitful fundamental principle Professor Mach has devoted a separate chapter. The following chapters are devoted to space and sight sensations, the discussion of the æsthetic sensations of symmetry, sensations of motion, perspective, spatial solidity, etc. The discussions here are extremely original and pregnant with valuable suggestions. Convincing views are advanced in the chapter on "Time-Sensation," while in the section on "Sensations of Tone" we have the suggestion of a new hypothesis which would reduce the many specific energies assumed by Helmholtz to two only. The criticism of the theories of sound-sensation have already contributed, and will in the future contribute, greatly to the elucidation of the relations obtaining in the province of tone. Not the least important chapter in the book is the last on "Physics," where the author shows the influence of his psychological investigations on the altered mode of conception of physics. This chapter is a distinct contribution to the theory of science. Although published eleven years ago, Professor Mach's book is one which by its solidity and the permanent value of its results will never grow old.

We have also to mention briefly the appearance of the second edition of the same author's *Popular Scientific Lectures*. Four new articles have been added to this volume, viz., "The Part Played by Accident in Invention and Discovery," the recent lecture on "Sensations of Orientation," and two brief essays on the history of "Acoustics" and of "Spatial Vision." The same edition will also shortly be increased by an entirely new article on "The Photography of Projectiles," making the augmentation of new matter considerably more than one hundred pages. (Price, $1.00. Fifty Cuts. 382 pages.) *p.*

VERSUCH EINER PHILOSOPHISCHEN SELEKTIONSTHEORIE. Von *Dr. phil. Johannes Unbehaun*. Jena: Gustav Fischer. Pages, 150. Price, 3 Marks.

Dr. Unbehaun has undertaken the task of critically examining the philosophical foundations of the theory of selection viewed as a general method of nature and thought. Darwin's principle has crept into all domains of knowledge and conduct, and so has become invested with an importance extending far beyond the special realm of biology. Dr. Unbehaun, accordingly, strips the theory of selec-